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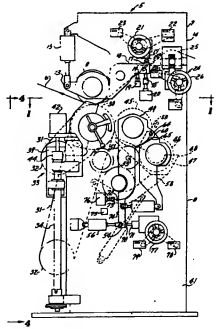
(54) **Flexographic belt printing press.**

(57) A compact printing press is described for use in multi-colour printing of a continuous web 6 of any suitable material, such as paper, plastics, or metal. The press comprises an impression cylinder assembly 7 in juxtaposed relation to a plate cylinder assembly 8 having a plate cylinder 30 around which a belt 31 with attached printing plates is at least partially reeved for printing on the continuous web 6 as it passes between the nip of the plate cylinder 30 and the impression cylinder 9 of the impression cylinder assembly. An engraved, ink transfer roller 45 and fountain roller 46 are disposed adjacent the plate cylinder, and are specially mounted for movement relative to each other and for movement in unison relative to the plate cylinder 30. Stops are provided to limit these movements. Any suitable doctor blade SB can be used in connection with the transfer roller 45, if desired.



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FLEXOGRAPHIC BELT PRINTING PRESS

The present invention is useful in the printing of a continuous web composed of any suitable material, e.g. paper, plastics, or metal. An important application of the invention is in the multi-colour flexographic printing of packaging material. It is a known disadvantage to use flexographic printing of a continuous web of packaging material, when the printing pattern on the plate cylinder contains large blank areas which produce corresponding blank areas and hence considerable waste of the web between the repetitive patterns of printed matter. Another disadvantage of using a conventional, flexographic printing press is that the plate cylinder must be changed to accommodate different size printing patterns and printing messages. Further, it is necessary to adjust the positions of the plate cylinder and the transfer and fountain rollers to adapt the press to plate cylinders of varying diameters. In practice, this adjustment is difficult and time-consuming. The invention in particular aims to provide a flexographic

-type printing press in which the aforementioned disadvantages are largely or wholly overcome.

Briefly stated, the invention particularly disclosed herein resides in a press which employs certain essential components of a flexographic printing press. The press is provided with a plate cylinder which is rotatable about its longitudinal axis. A continuous belt, carrying printing plates similar to those used in normal flexographic printing, is reeved at least partially around the plate cylinder and properly tensioned to print on a continuous web of any suitable material, e.g. packaging material. An engraved ink transfer roller, rotatable about its longitudinal axis, is disposed adjacent and parallel with the plate cylinder and is movable to and from the plate cylinder for contacting the printing plates carried by the belt. A fountain roller, also rotatable about its longitudinal axis, is positioned adjacent and parallel with the transfer roller. Moreover, the fountain roller is movable to and from the transfer roller for contacting it and coating it with ink carried by the fountain roller. Thus, means are provided for mounting the fountain and transfer rollers for relative movement to and from each other and for movement in unison towards and away from the plate cylinder.

A big advantage of using a belt-type printing press is that the size and location of the plate cylinder, transfer and fountain rollers need not be changed when the length of the printing pattern is changed. It is only necessary to change the belt to produce different printing patterns or to alter the size of the printed matter on the continuous web. The arrangement disclosed herein allows for easy belt changing.

The following description of an illustrative and non-limiting invention will be better understood by having reference to the accompanying drawings, wherein:

Figure 1 is a plan view of one example of a belt-type printing press in accordance with the invention as seen from the line 1-1 of Figure 2;

Figure 2 is a side elevation of the press, as viewed from the line 2-2 of Figure 1;

Figure 3 is a side elevation of the press, as viewed from the line 3-3 of Figure 1; and

Figure 4 is an end elevation of the press, as viewed from the line 4-4 of Figure 2.

With reference to the drawings, there is shown a belt-type printing press 5 which is designed for printing on a continuous web 6 of any suitable material such as paper, plastics, or metal. The printing press 5

comprises an impression cylinder assembly 7 which is in juxtaposed relation vertically above a plate cylinder assembly 8 when the press 5 is in a normal vertical position and rests on a horizontal surface.

Impression Cylinder Assembly

The impression cylinder assembly 7 comprises an impression cylinder 9 which is rotatable about its longitudinal axis that is normal to the direction in which the continuous web 6 travels as it moves to and from the impression cylinder 9. The impression cylinder 9 is rotatably mounted between a pair of parallel pivot arms 10, 11, each of which have a pair of opposing ends 12, 13. The pivot arms 10, 11 are mounted on the upper framework 14 of the printing press 5 for unitary rotation about an axis which is parallel to the rotational axis of the impression cylinder 9 and located intermediate the opposing ends 12, 13 of the pivot arms 10, 11.

A pair of air cylinders 15, 16, designed to function in unison, are operatively connected between the upper framework 14 of the printing press 5 and adjacent ends 13 of the pivot arms 10, 11, to rotate the impression cylinder 9 about the rotational axis of the pivot arms 10, 11, between operating and non-operating positions, i.e. into and out of printing relation with the plate cylinder assembly 8. The free ends 12 of the pivot

arms 10, 11 each carry a plurality of adjustable stops 17-19 which are strategically located for engaging a set of correspondingly positioned abutments or stops 17'-19' adjacent each of the free ends 12 of the pivot arms 10, 11 to control the positioning of the impression cylinder 9. The vertically uppermost set of stops 17, 17' are used in the positioning of the impression cylinder 9 in its vertically lowermost operating position relative to the plate cylinder assembly 8. The first to encounter vertically lowermost set of stops 18, 18' are designed to regulate the normal non-operating position of the impression cylinder 9, out of printing engagement with the plate cylinder assembly 8. The second to encounter lowermost set of stops 19, 19' are used to regulate the fully retracted position of the impression cylinder 9 away from the plate cylinder assembly 8, to permit the continuous web 6 to be more conveniently threaded through the impression cylinder assembly 7. Similar conventional air cylinders 20 are provided to reposition the first to encounter set of stops 18, 18' to permit engagement of the second to encounter set of stops 19, 19'.

A hand operated wheel 21, in conjunction with a pair of digital readout devices 22, 23 correlated to the turning of the wheel 21 is provided to help an operator locate the set of operating stops 17, 17' to properly position the impression cylinder 9 for printing

relation with the plate cylinder assembly 8.

A compensator roller mechanism 24 is used to adjust the length of the pathway which the continuous web 6 travels between a pair of similar adjacent printing presses 5 normally employed in a multi-colour printing operation to control the registration of colour to colour. The mechanism 24 comprises a spring biased compensator roller 25 whose vertical position is automatically controlled by operation of a motor, or manually adjusted by a hand operated wheel 26 in conjunction with a pair of digital readout devices 27, 28, similar to that used in adjusting the position of the operating stops 17. The spring biased compensator roller 25 is designed to rotate freely about its longitudinal axis which is parallel to the rotational axis of the impression cylinder 9. Any other suitable means can be used, to bring about registration of colour to colour, if desired.

Plate Cylinder Assembly

The plate cylinder assembly 8 comprises a plate cylinder 30 which is rotatable about its longitudinal axis that is parallel to the rotational axis of the impression cylinder 9. A continuous flexible belt 31 is at least partially reeved around the plate cylinder 30 and carries a plurality of printing plates similar to

those used in a conventional flexographic printing process. The printing plates are bonded in position on the flexible belt 31 which is composed of any suitable material, as is well known in the trade. The belt 31 is also reeved at least partially around a smaller roller 32 which is provided to tension the belt 31 on the plate cylinder 30. The belt tensioning roller 32 is mounted for rotating freely about its longitudinal axis which is parallel to the rotational axis of the plate cylinder 30. Any suitable mechanism 33 may be used to adjust the position of the belt tensioning roller 32 relative to the plate cylinder 30, to accommodate belts of different lengths used in the multi-colour printing process.

For example, the mechanism 33, as best seen in Figure 4, comprises a pair of vertically disposed parallel drive screws 34, 35 which are operatively connected to any suitable drive mechanism 36 for rotating the drive screws 34, 35, in unison. A pair of parallel guide rods 37, 38 are disposed in parallel relation within the drive screws 34, 35, and a pair of carriages 39, 40, are slidably mounted on the guide rods 37, 38, and coupled to the drive screws 34, 35 which, when rotated, cause the carriages 39, 40 to move along the guide rods 37, 38. The belt tensioning roller 32 is rotatably mounted between the carriages 39, 40. The pair of drive screws 34, 35 are allowed to float, i.e.

they are mounted for limited axial movement relative to the adjacent guide rods 37, 38 which are fixedly mounted on the lower framework 41 of the printing press 5.

A pair of similar, double acting air cylinders 42, 43 are coupled by any suitable means 44 to the drive screws 34, 35 and carriages 39, 40 to counterbalance the weight of the belt tensioning roller 32 and to place a desired, downwardly directed force or load on the carriages 39, 40 to correspondingly move the belt tensioning roller 32 to a position where the belt 31 is placed under a predetermined tension on the plate cylinder 30 for printing engagement with the continuous web 6 passing between the nip of the impression cylinder 9 and plate cylinder 30.

A conventional, engraved ink transfer roller 45 and fountain roller 46, as best seen in Figures 2 and 3, are associated with the plate cylinder 30 and employed to transfer ink 47 from a fountain 48 to the printing plates carried by the belt 31. Any suitable mechanism such as an air loaded doctor or scraper blade SB can be used, if desired, to remove excess printing ink from the transfer roller 45. The scraper blade SB can be mounted in a positive angle position, as shown in Figure 2, or a reverse angle position as shown in Figure 3.

The fountain 48 is mounted by any appropriate means for movement to and from the fountain roller 46. The transfer roller 45 and fountain roller 46 are, like the belt tensioning roller 32, mounted for rotation about their own particular longitudinal axes which are parallel to the rotational axis of the plate cylinder 30. The transfer roller 45 is rotatably mounted between adjacent ends 49, 50 of a pair of parallel arms 51, 52 which are provided to support both the transfer roller 45 and the fountain roller 46 on the plate cylinder assembly 8. The support arms 51, 52 are mounted for rotation about an axis 53 which is parallel to the rotational axis of the plate cylinder 30 and which is located intermediate the rotational axis of the transfer roller 45 and opposing free ends 54, 55 of the support arms 51, 52. A pair of air cylinders 56, 57 are coupled between the lower framework 41 of the printing press 5 and the adjacent free ends 54, 55 of the support arms 51, 52 to rotate the support arms 51, 52 and move the transfer roller 45, carried thereby, to and from the plate cylinder 30.

The fountain roller 46 is rotatably mounted between a pair of parallel pivot arms 58, 59 intermediate opposing ends 60, 61 and 62, 63 thereof. The ends 60, 61 of the pivot arms 58, 59, closest the transfer roller 45, are pivotally mounted by similar pivot pins 64 to a pair of brackets 65, 66 which project from the support arms 51, 52 in parallel relation adjacent the transfer roller 45.

A pair of air cylinders 67, 68 are coupled between the opposing free ends 62, 63 of the pivot arms 58, 59 and the adjacent free ends 54, 55 of the support arms 51, 52 to rotate the fountain roller 46 to and from the transfer roller 45. Thus, the transfer roller 45 and fountain roller 46 are mounted for relative rotational movement to and from each other and for unitary rotational movement (i.e. movement in unison) towards and away from the plate cylinder 30.

A plurality of sets of stops 70, 71 and 72, 73 and 74, 75 similar to those used in conjunction with the support arms 10, 11 of the impression cylinder 9, are provided for coaction with the free ends 54, 55 of the support arms 51, 52 of the transfer roller 45, to position the transfer roller 45 for engagement with, and disengagement from, the printing plates carried by the belt 31 and passing around the plate cylinder 30. The first set of stops 70, 71, closest the free ends 54, 55 of the support arms 51, 52, are utilized to position the transfer roller 45 adjacent the plate cylinder 30 for transferring ink to the printing plates carried by the belt 31. The second set of stops 72, 73 are used to regulate the normal position of the transfer roller 45 out of engagement with the printing plate carried by the flexible belt 31. Conventional air cylinders 76 are also provided to retract the stops 73 of the second set of stops 72, 73 out of interference

with the coaction of the third set of stops 74, 75, at which point the transfer roller 45 is in farthest spaced relation from the plate cylinder 30. A hand operated wheel 77 and digital readout devices 78, 79 are likewise employed to position the first set of stops 70, 71 for controlling the ink transferring position of the transfer roller 45 relative to the plate cylinder 30.

The plate cylinder 30 and transfer roller 45, as best seen in Figures 1 and 3, are conventionally geared together for synchronized rotation relative to the linear speed at which the web 6 travels between the nip of the impression and plate cylinders 9, 30 and are operated by any appropriate drive mechanism which is coupled to the projecting end 80 of a power input shaft 81 that is geared to the plate cylinder 30 and transfer roller 45. The fountain roller 46 is operated or rotated independently of the transfer roller 45 by any suitable motor means M and at a speed and distance from the transfer roller 45 sufficient to meter a uniform and constant desired flow of ink to the printing plates carried by the belt.

A motor driven or hand operated wheel 82 and locking mechanism 83 are provided for use by an operator in axially adjusting the position of the plate cylinder 30 relative to the impression cylinder 9.

Thus, there has been described a novel, compact printing press which is especially suitable for use in multi-colour printing of a continuous web of any appropriate packaging material. In a specially advantageous arrangement, a number of these compact printing presses are disposed one after the other to successively print upon the moving web, the different colours used in the multi-colour printing process.

CLAIMS

1. A printing press including

a plate cylinder 30,

a continuous flexible belt 31 reeved at least partially around the plate cylinder and carrying a plurality of plates for printing on a travelling web 6,

means mounting the plate cylinder for rotation about the longitudinal axis thereof, and

a transfer roller 45 and fountain roller 46 disposed adjacent the plate cylinder for transferring ink from a fountain to the printing plates carried by the belt characterised by the combination of:-

means associated with the plate cylinder 30 for tensioning the belt;

means 51, 52 mounting the transfer roller and fountain roller for rotation about their respective longitudinal axes which are parallel to the rotational axis of the plate cylinder; and

means 58, 59 mounting the transfer roller 45 and fountain roller 46 for relative movement towards and away from each other and for movement in unison towards and away from the plate cylinder 30.

2. The press of claim 1, which includes:

an impression cylinder 9 disposed in spaced relation from the plate cylinder 30;

means mounting the impression cylinder for rotation about the longitudinal axis thereof, which axis is

parallel with the rotational axis of the plate cylinder; and

means 10, 11 mounting the impression cylinder for movement between a plurality of specific and predetermined positions spaced from the plate cylinder.

3. The press of claim 1 or 2 wherein the means for tensioning the belt reeved on the plate cylinder includes:

(I) a belt tensioning roller 32 disposed parallel to the plate cylinder and around which the continuous belt 31 is also at least partially reeved; and

(II) a means 33 for adjusting the position of the belt tensioning roller relative to the plate cylinder, to tension the belt on the plate cylinder and accommodate the use of different length printing belts in the printing press.

4. The press of claim 3, wherein the means for adjusting the position of the belt tensioning roller includes:

(III) a pair of parallel drive screws 34, 35;

(IV) a pair of guide rods 37, 38 fixedly disposed parallel to the drive screws;

(V) a pair of carriages 39, 40 operatively connected to the drive screws and slidably mounted on the guide rods 37, 38 for movement in unison therealong towards and away from the plate cylinder 30;

(VI) means mounting the belt tensioning roller 32 between the carriages for rotation about the longitudinal axis of the roller;

(VII) means mounting the drive screws 34, 35 for limited axial movement relative to the guide rods; and

(VIII) means 42, 43 coacting with the carriages 39, 40 for counterbalancing the weight of the belt tensioning roller 32 on the drive screws and for applying a predetermined desired force to the belt tensioning roller to tension the belt.

5. The press of claim 1, 2, 3 or 4 wherein the means mounting the transfer roller and the fountain roller for relative movement towards and away from each other and for movement in unison towards and away from the plate cylinder, comprises:

(i) a pair of support arms 51, 52 having opposing ends;

(II) means for rotatably mounting the transfer roller between the pair of support arms adjacent the ends thereof closest the plate cylinder;

(III) means for rotatably mounting the support arms intermediate opposing ends thereof for rotation about an axis 53 which is parallel to the rotational axis of the plate cylinder;

(IV) means coacting with the free ends of the support arms farther from the plate cylinder for rotating the

support arms, in unison, about the rotational axis thereof to correspondingly move the transfer roller in an arcuate path towards and away from the plate cylinder;

(V) means for limiting the extent of rotation of the support arms to correspondingly limit the movement of the transfer roller to selected ones of a plurality of positions spaced from the plate cylinder;

(VI) a pair of pivot arms 58, 59 having opposing ends and located adjacent the support arms;

(VII) means for rotatably mounting the fountain roller between the pair of pivot arms intermediate the opposing ends thereof;

(VIII) means mounting those ends of the pivot arms which are closer to the transfer roller on the support arms for rotation about an axis which is parallel to the rotational axis of the transfer roller; and

(IX) means 67, 68 coupled between the support arms and adjacent free ends of the pair of pivot arms farther from the transfer roller, for rotating the pivot arms, in unison, about the rotational axis thereof to correspondingly rotate the fountain roller 46 towards and away from the transfer roller 45.

6. The press of any one of the preceding claims which includes means for varying the distance a web travels between impression cylinders of a pair of adjacently disposed similar printing presses.

7. The press of claim 5, wherein the means (V) for limiting the extent of rotation of the support arms includes a plurality of stops disposed for contacting the free ends of the support arms as they rotate in either direction about the rotational axis thereof, and means for adjusting the positions of the stops relative to the support arms.

8. The press of any of claims 1 - 5 and 7 including a compensator roller 25 disposed adjacent the impression cylinder 9 for engaging the travelling web upstream of the impression cylinder, and

means 24 mounting the compensator roller for rotation about the longitudinal axis thereof, which axis is parallel to the rotational axis of the impression cylinder.

9. The press of claim 8 including:

means for rotating the plate cylinder and transfer roller in synchronized relation about their individual rotational axes in correlated relation to the speed at which the web travels between said nip.

10. The press of claim 1, 2 or 3, wherein the means for mounting the transfer roller and fountain roller for relative movement and movement in unison, includes:

(I) a pair of support arms 51, 52 having opposing ends;

(II) means for rotatably mounting the transfer roller between the pair of support arms adjacent the ends thereof closest the plate cylinder;

(III) means for rotatably mounting the support arms intermediate opposing ends thereof for rotation about an axis which is parallel to the rotational axis of the plate cylinder;

(IV) means coacting with the free ends of the support arms farthest from the plate cylinder for rotating the support arms, in unison, about the rotational axis thereof to correspondingly rotate the transfer roller carried thereby to and from the plate cylinder;

(V) a pair of pivot arms 58, 59 having opposing ends and being adjacent the support arms;

(VI) means for rotatably mounting the fountain roller between the pair of pivot arms intermediate the opposing ends thereof;

(VII) means mounting the ends of the pivot arms closest the transfer roller, on the support arms for rotation about an axis which is parallel to the rotational axis of the transfer roller;

(VIII) means coupled between the support arms and adjacent free ends of the pair of pivot arms farthest from the transfer roller, for rotating the pivot arms, in unison, about the rotational axis thereof to

correspondingly rotate the fountain roller to and from the transfer roller; and the means (s) for restricting movement of the transfer roller between a plurality of positions spaced from the plate cylinder, includes:

(IX) a plurality of stops 70 to 75 for restricting rotation of the support arms in either direction about its rotational axis to correspondingly limit the arcuate movement of the transfer roller between a plurality of positions spaced from the plate cylinder; and

(X) means 76 for adjusting the positions of the stops.

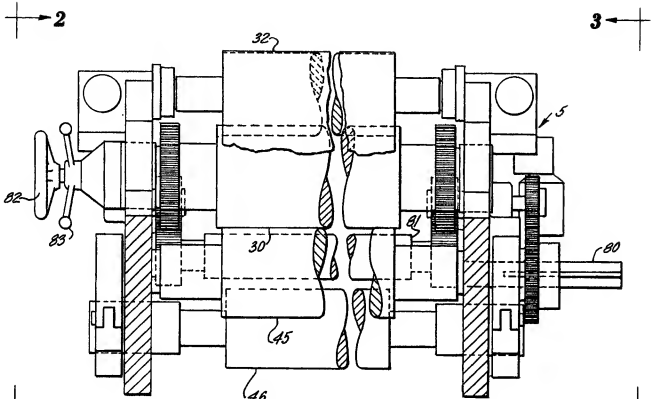

FIG. 1

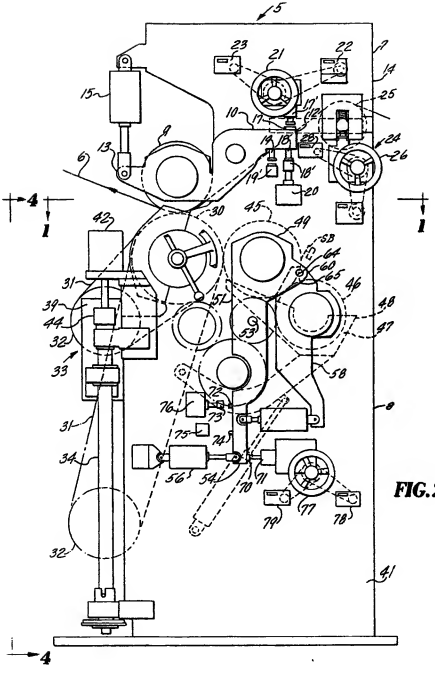
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FIG. 2

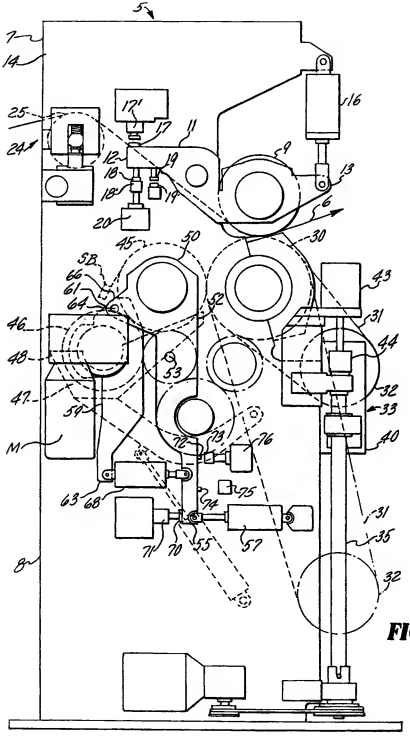
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FIG. 3

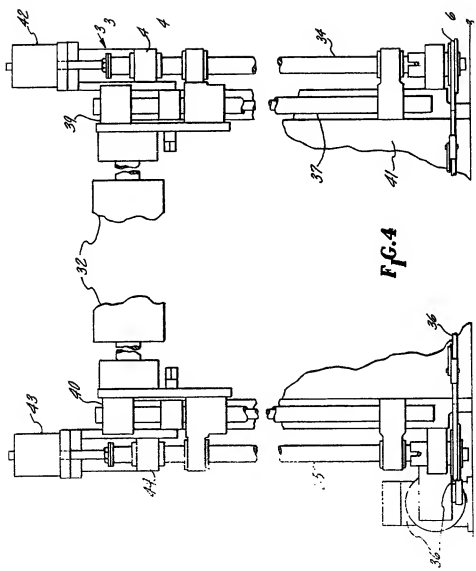

FIG.4

European Patent Office

EUROPEAN SEARCH REPORT

Application number
0029312
EP 80 30 3828

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	DE - C - 689 218 (HUBNER) * The complete description * --	1,3,4	B 41 F 5/04
	GB - A - 1 215 195 (CAMERON) * Page 4, line 122 to page 6, line 40; figures * --	1,3,4	
	US - A - 3 762 323 (STALEY) * The complete description * --	1,5,9 10	TECHNICAL FIELDS SEARCHED (Int. Cl.³)
	GB - A - 1 065 154 (DE LA RUE) * The complete description * --	2	B 41 F
	US - A - 3 416 444 (LEE MACHINERY) * Column 5, line 56 to column 6, line 33; figures 1-7 * ----	6,8	

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13-02-1981	LONCKE

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